

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of)
)
Amendment of Part 18 of the Rules to) RM-_____
Expand the Exemption for ISM Devices)
Used as Components in Transportation)
Vehicles)

To: The Commission

PETITION FOR RULEMAKING

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SUMMARY

Rapid technological developments are taking place with respect to the use of wireless systems, digital processing, and sensors as components within cars, trucks, aircraft, and maritime vessels to enable them to operate in a more safe and efficient manner, with the ultimate goal of autonomous operations. These autonomous vehicles employ substantial numbers of small components that use RF energy for internal monitoring and sensing purposes. The RF emissions from these devices are generally negligible, posing no appreciable risk of harmful interference to other authorized uses of radio spectrum.

The Commission has established goals of promoting the development of new technologies and services, along with eliminating regulations that are no longer needed and potentially inhibit commerce. Consistent with these goals, the Commission should streamline its rules governing the use of ultrasonic and digital components in transportation vehicles to assist manufacturers and promote U.S. commerce. Presently, Section 15.103 of the rules exempts from the Commission's technical standards and equipment authorization requirements digital components used in a wide variety of products and equipment, including aircraft, automobiles, home appliances, and specialized medical equipment. The existence of these exemptions has not resulted in harmful interference to other authorized spectrum uses. At the same time, these exemptions have freed manufacturers to employ digital processing in an ever increasing number of products and equipment, enabling them to provide additional services to consumers, while operating more efficiently and using less power.

The Commission should expand the scope of the exemptions that it maintains in Section 15.103 of its rules. Specifically, the Commission should create an identical exemption from its technical standards and equipment approval requirements for industrial, scientific, and medical

(“ISM”) devices used as components for operational and monitoring purposes in transportation vehicles. The operating conditions of these ISM components are very similar to the operating conditions of digital devices employed by vehicle manufacturers. Further, Commission precedent already exists for such an exemption, which is reflected in the Commission’s exemption for ISM equipment employed in specialized medical devices.

Finally, the Commission should create an explicit exemption in Section 15.103 of its rules for digital components employed within maritime vessels, particularly autonomous maritime vessels that are rapidly being developed for both surface and submersible operations. The justifications for exempting such components in maritime vessels is as compelling – if not more so – as the long standing justification for exempting such components in aircraft and automobiles.

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The Boeing Company (“Boeing”), through its counsel and pursuant to Section 1.401 of the Commission’s Rules, 47 C.F.R. § 1.401, hereby petitions the Commission to streamline its rules for the use of certain RF devices that are used as components within the operational and monitoring systems of transportation vehicles, including cars, trucks, aircraft, and maritime vessels.

Perhaps the single greatest technological challenge of this generation is the use of wireless systems, digital processing, and sensors to further heighten the operational safety and efficiency of motor vehicles, aircraft, and maritime vessels, with the ultimate goal of autonomous operations. Autonomous and semi-autonomous vehicles employ a substantial number of electronic components that use RF energy at very low power levels for internal monitoring, short range communications, and to perform other important functions within the vehicle. These electronic devices monitor and control the operations of the vehicle, monitor conditions around the vehicle, and produce data that is communicated to the vehicle “operator” and often to adjacent vehicles. The RF emissions from these myriad devices are generally negligible, posing no appreciable risk of harmful interference to other authorized uses of radio spectrum, be they devices outside the vehicle, consumer devices carried by passengers within the vehicle, or the various other RF components that are incorporated with the vehicle itself.

Despite these common characteristics, many of the RF components incorporated within transportation vehicles are regulated under the Commission's rules using divergent regulatory structures and requirements. Boeing urges the Commission to streamline and harmonize its rules to support the important technological developments that are taking place with respect to autonomous vehicle systems. A reduction in regulatory impediments to the use of small wireless and digital devices in autonomous vehicle systems would advance the Commission's recently announced initiative to increasingly promote the development of new technologies and services consistent with Section 7 of the Communications Act.¹ Such a streamlining effort would also be consistent with the goals of this Administration to eliminate unnecessary and burdensome regulations that inhibit the growth and development of U.S. commerce.²

The streamlining measures that Boeing proposes entail relatively modest changes to the Commission's rules that would be entirely consistent with regulatory provisions that already exist. Specifically, the Commission should initiate and complete a rulemaking that adopts the following changes to its rules:

- Expand the scope of Section 18.121 (Exemptions) to indicate that industrial, scientific, and medical ("ISM") equipment used exclusively in the monitoring and control systems of any transportation vehicle (but not to power the vehicle) are subject only to the provisions of Sections 18.105, 18.109 through 18.119, 18.301 and 18.303 of Part 18.

¹ See Encouraging the Provision of New Technologies and Services to the Public, FCC 18-18, *Notice of Proposed Rulemaking*, GN Docket No 18-22, ¶ 1 (Feb. 23, 2018) (observing that technological advancements are "vital in fueling the economic engine of the United States and benefiting consumers").

² See, e.g., David Shephardson, *New FCC Chair Vows to Shrink Industry Regulations*, Reuters (Jan. 31, 2017), <http://www.reuters.com/article/us-fcc-regulations-idUSKBN15F26Z> (quoting Chairman Pai in explaining that one of his primary goals is "to remove unnecessary or counterproductive regulations from the books," and "make sure that our regulations match the realities of the modern marketplace").

- Supplement Sections 15.103(a) and 18.121 to explicitly indicate that digital devices used exclusively within maritime vessels are subject only to the general conditions of operation in Sections 15.5 and 15.29 (or Sections 18.105, 18.109 through 18.119, 18.301 and 18.303) and are exempt from the specific technical standards and other requirements contained in Parts 15 and 18 of the rules.

The adoption of these streamlining measures would greatly assist manufacturers of transportation vehicles, along with the thousands of their suppliers of RF components that are incorporated within these vehicles, to enhance their operational performance, efficiency and safety. The current rules impose significantly different regulatory requirements on many RF components based on the types of functions they perform and often not based on differing levels of interference risk. As a result, Boeing and other manufacturers of increasingly complex transportation vehicles are faced with a constant compliance challenge of ascertaining the appropriate regulatory status of each component employed in a vehicle – many components often fall within multiple classifications, including both Part 15 and Part 18 – and educating domestic and international suppliers on the testing, equipment authorization, and importation requirements for each device.

As a global leader in the design and manufacture of aircraft and aerospace systems, Boeing employs a very wide range of wireless systems, including for research and development, for worker safety and automated manufacturing, for aircraft flight testing, and incorporated within the operational systems of each aircraft, defense system, and space vehicle manufactured by Boeing. Boeing is leading the aviation industry in the field of unmanned aircraft systems (“UAS”), including advocating for the safe design and integration of wireless monitoring and sensing systems that support perception, machine learning, and advanced flight control systems. Boeing’s UAS can be customized with mission-specific technologies for a wide range of tasks, including search and rescue, disaster response, asset and force protection, border security, wildlife monitoring, agricultural assessment, communications relay, anti-piracy, and firefighting. The UAS systems that have been developed by Boeing and its subsidiaries have accumulated millions

of flight hours in remote conditions throughout the world. Boeing's UAS products are being used by the U.S. government for homeland security and have been used for more than a decade by the U.S. Marine Corps and the U.S. Navy.

Boeing is also a leader in the development of autonomous maritime systems used for surveillance, exploration, security, and scientific research in remote oceanic regions. For example, Boeing's Liquid Robotics subsidiary is using two autonomous ocean robots to monitor lava flows into the ocean from Hawaii's Kilauea Volcano. These autonomous vehicles are powered by energy harvested from the sun and ocean waves, and are equipped with a wide assortment of sophisticated sensors to measure water temperatures, oxygen levels, pH levels, salinity, turbidity, conductivity and underwater acoustics. Boeing's autonomous ocean robots are also being used to monitor ocean conditions near the Arctic ice caps.

To support its varied research and manufacturing efforts, Boeing purchases and imports millions of aircraft, vehicle and space system components from its immense global supply chain and engages in exhaustive efforts to confirm the equipment verification or certification status of each of these devices, often having to educate technology vendors regarding the complexities of the Commission's equipment approval and importation rules. In addition, Boeing routinely provides comment to the Commission on rulemakings and public notices intended to improve the Commissions' regulatory requirements and optimize its management of scarce spectrum resources to facilitate the growth of new licensed and unlicensed communications services, while ensuring the safe and reliable operation of existing spectrum uses supporting public safety, disaster relief, aircraft navigation and landing systems, flight testing, radar, precision location, and satellite broadband and video distribution, to name a few. Boeing also routinely holds more FCC experimental licenses than any other entity.

With this background, Boeing urges to the Commission to streamline its rules for Part 18 devices that are used exclusively as components within transportation vehicles to enhance their safety, efficiency and autonomous capabilities. Such measures would remove costly, administratively burdensome and unnecessary regulations on U.S. manufacturers and high tech developers, thus facilitating the continued growth and U.S. leadership in these critical industries to the substantial benefit of domestic consumers and to the role of the United States in international trade.

I. SUBSTANTIAL PRECEDENT AND GOOD CAUSE EXISTS TO STREAMLINE THE COMMISSION’S RULES FOR EXEMPTED RF COMPONENTS USED IN TRANSPORTATION VEHICLES

The spectrum usage environment in the United States has evolved exponentially in the past two decades and the Commission’s rules must constantly evolve with it, lest they inhibit innovation and advancement of technology and services. Today, small digital devices are routinely carried by nearly every person and are incorporated within the electronics of a wide variety of “things,” from cars and appliances, to toys, entertainment devices, manufacturing systems, and other useful equipment. Radio signals radiate (or leak) from most of these devices, including in restricted frequency bands that are used for the most sensitive communications equipment.

Presciently, the Commission began regulating the RF emissions of digital devices in 1979 because of concern that the proliferation of these electronic products could interfere with over-the-air radio and television reception.³ The Commission adopted RF emissions limits for products containing digital processing equipment which are reflected in Section 15.109 of the Commission’s rules. These limits – expressed in microvolts per meter – are divided into two

³ See Amendment of Part 15 to Redefine and Clarify the Rules Governing Restricted Radiation Devices and Low Power Communication Devices, *First Report*, FCC 79-555 (Oct. 11, 1979).

categories (Class A and Class B digital devices), with slightly more stringent emission limits for digital devices that are likely to be used in residential settings near sensitive radio and television receivers. Today, small digital devices that comply with these restrictions are in use everywhere and, as a result, manufacturers of radio communications equipment and other sensitive devices routinely design their products to tolerate this baseline noise.

Shortly after the Commission adopted its rules for digital devices, the Commission recognized the need to create exemptions for digital devices that are incorporated into larger equipment, specifically automobiles and aircraft.⁴ Such devices are subject only to the general requirement to refrain from causing harmful interference.⁵ The Commission explained that this exemption was warranted because special testing procedures would likely be needed for such devices, the potential benefits of which would unlikely be justified by the costs.⁶

In 1981, the Commission created an additional exemption for specialized medical digital devices.⁷ The Commission observed that an exemption was justified “particularly in view of the many factors which minimize the likelihood of interference, and in view of the high costs of

⁴ See Amendment of Part 15 to Redefine and Clarify the Rules Governing Restricted Radiation Devices and Low Power Communication Devices, FCC 80-148, *Order on Reconsideration*, 79 F.C.C.2d 67, ¶¶ 54-55 (April 9, 1980) (“1980 Order on Reconsideration”).

⁵ See 47 C.F.R. § 15.103 (explaining that such devices are subject only to the general conditions of operation in §§ 15.5 and 15.29). The exemptions that are currently included in Section 15.103 were originally codified as temporary exemptions in Section 15.801 of the Commission’s rules. See Revision of Part 15 of the Rules Regarding the Operation of Radio Frequency Devices Without an Individual License, FCC 89-103, *First Report and Order*, 4 FCC Rcd 3493, ¶ 141 n.61 (Apr. 18, 1989) (moving the exemptions from Section 15.801 to Section 15.103 of the Commission’s rules and making the exemptions permanent).

⁶ See 1980 Order on Reconsideration, ¶ 55.

⁷ See Request of General Electric Company to Exempt Medical Diagnostic Equipment From Subpart J of Part 15 of the Rules of the Federal Communications Commission, FCC 82-301, *Report and Order*, 90 F.C.C.2d 666 (July 9, 1982).

compliance.”⁸ Today, the Commission maintains a lengthy list of exempted digital devices, including exemptions for devices used in:

- (a) transportation vehicles including motor vehicles and aircraft;
- (b) electronic control or power systems used by a public utility or in an industrial plant;
- (c) industrial, commercial, or medical test equipment;
- (d) appliances, *e.g.*, microwave oven, dishwasher, clothes dryer, air conditioner, etc.;
- (e) specialized medical digital devices;
- (f) devices that have a power consumption not exceeding 6 nW;
- (g) joystick controllers or similar devices, such as a mouse; and
- (h) certain devices in which both the highest frequency generated and the highest frequency used are less than 1.705 MHz.⁹

With respect to all of these exempted digital devices, the exemption was warranted based on “evidence indicating that the risk of interference was minimal and that the cost of compliance with a specific emanation requirement would be high.”¹⁰

The existence of these exemptions has permitted equipment manufacturers to incorporate digital devices in a myriad of products and systems without resulting in harmful interference to other important spectrum uses. This general absence of harmful interference is due to several factors. Many digital devices are incorporated within larger products that include outer casings or chassis that effectively shield much of the radiated emissions. Many of these larger products also incorporate multiple RF components within them that must be shielded from each other to

⁸ *Id.*, ¶ 13.

⁹ 47 C.F.R. § 15.103.

¹⁰ Amendment of the Exemptions in Subpart J of Part 15 of the Commission Rules for Controlling the Interference Potential of Computers and Similar Electronic Equipment, FCC 84-401, *Notice of Proposed Rulemaking*, 98 F.C.C.2d 1211, ¶ 7 (Aug. 21, 1984).

ensure the reliable operation of the larger product. In addition, some of the products that contain exempted digital devices are used in medical, aviation and industrial settings where trained personnel can manage their placement and operation. Finally, the RF emissions from most of these exempted digital devices are so low that they would not create an interference concern regardless of how or where they are used.

As a result, the Commission's permissive treatment of exempted digital devices, combined with its relatively modest regulation of digital devices that are not subject to an exemption, has been tremendously successful. Digital devices generally do not cause harmful interference into licensed or unlicensed wireless systems. At the same time, manufacturers have been able to incorporate inexpensive digital devices into nearly all types of products and equipment, enabling those products to operate more effectively and efficiently, using less power and providing more services to consumers than could ever have been possible without these computing capabilities.

Given the Commission's tremendous success in this area, Boeing urges the Commission to evolve its rules and employ these same principles to other equipment and devices that are regulated by the Commission under its rules. Specifically, the Commission should employ these same exemptions to ISM equipment regulated under Part 18 of the Commission's rules that is used in the monitoring and control systems of transportation vehicles. In addition, the Commission should create a new exemption for maritime vessels, particularly to support the rapidly developing field of autonomous maritime vessels. The expansion of the Commission's exemptions in this manner will further facilitate their incorporation and use within increasingly autonomous vehicles that are made available by manufacturers to benefit consumers and commerce in the United States.

A. The Commission Should Adopt Identical Exemptions for Industrial, Scientific, and Medical Equipment Under Part 18 of its Rules

The Commission has historically maintained separate rules for low power RF emitting equipment used for communications (which are generally regulated under Part 15) and RF transmitting equipment used for ISM purposes (which are regulated under Part 18). The divergent regulatory treatment is based solely on this difference in use, not because of appreciable difference in their potential impact on the interference environment.

In practice, the usage conditions for ISM equipment are often very similar to the usage conditions for digital devices. As the Commission's rules observe, typical ISM applications are the production of physical, biological, or chemical effects such as heating, ionization of gases, mechanical vibrations, hair removal and acceleration of charged particles.¹¹ Many ISM systems are incorporated within larger products that include outer casings or chassis that effectively shield emissions. Some of these larger products also incorporate multiple RF components, necessitating that these components be shielded from each other. In addition, nearly all non-residential ISM systems are used in professional or industrial settings where trained personnel can manage their placement and operation. Finally, the RF emissions from most ISM devices are so low that they would not create an interference concern regardless of how or where they are employed. Given these facts, the Commission should adopt in Part 18 of its rules the same exemptions for ISM equipment used as components in the monitoring and control systems of transportation vehicles that it maintains in Section 15.103 of its rules for digital devices used in transportation vehicles.

Precedent exists for the Commission's treatment of ISM equipment in the same permissive manner as exempted digital devices. In 1986, the Commission adopted an exemption for non-

¹¹ See 47 C.F.R. §18.107(c).

consumer medical ultrasonic equipment from the testing requirements of Part 18.¹² In 1994, the Commission expanded this exemption to include non-consumer magnetic resonance equipment.¹³ Advocates for these exemptions highlighted the fact that the RF emissions produced by the ultrasonic portions of such equipment were comparable to the RF emissions from the digital processing portions of these same devices, the latter of which had already been exempted by the Commission from the testing requirements of Part 15.¹⁴ In concurring with this position, the Commission observed that the interference risks of such an exemption were minimal and the reduced costs to medical equipment manufacturers would be significant.¹⁵

The Commission should reach this same conclusion with respect to ISM equipment used as components on transportation vehicles. Most such components are not modular, meaning they cannot be tested as separate devices prior to their incorporation into aircraft or other transportation systems. Further, such components do not generate RF energy in their unassembled state. Thus, testing such components prior to their installation on a transportation vehicle is difficult. Once assembled as a part of the vehicle, testing becomes even more difficult because the component is often housed deep within the vehicle frame.

As an example, Boeing installs ultrasonic water detectors within the fuel tanks of large aircraft. These devices are installed within the aircraft fuel tanks and, once installed, the RF

¹² See Amendment of Part 18 of the FCC Rules to exempt medical ultrasonic diagnostic and monitoring equipment from technical standards, FCC 86-493, *Report and Order*, 1 FCC Rcd 553 (Nov. 12, 1986) (“1986 Part 18 Order”).

¹³ See Amendment to Part 18 to Remove Unnecessary Regulations Regarding Magnetic Resonance Systems, FCC 94-155, 9 FCC Rcd 3389 (July 12, 1994) (“1994 Part 18 Order”).

¹⁴ 1986 Part 18 Order, ¶¶ 2 and 4.

¹⁵ See *id.*, ¶ 6; see also 1994 Part 18 Order, ¶ 6.

emissions from these detectors are largely undetectable outside the fuel tanks. For these reasons, it is both impractical and unnecessary to continue to impose the Commission's technical standards and equipment approval rules to these Part 18 devices.

As a second example, ultrasonic sensors are being installed in both cars and aircraft that are used to detect the proximity of the vehicle to external objects, such as other cars or taxiing aircraft, pedestrians, or fixed objects. These sensors use RF energy to generate ultrasonic signals, but the RF emissions from such devices are negligible.

As a third example, Boeing equips all major aircraft with ultrasonic emergency locator beacons, which activate only in the extremely unlikely event of being submerged in water. The beacons are Part 18 devices because they use RF energy to generate an underwater acoustic beacon and do not transmit an RF signal. Importantly, given the fact that the devices are activated only when submerged in water, they pose no interference threat to other spectrum uses and therefore should appropriately be treated as exempted devices.

In identifying these examples, Boeing emphasizes that it is not seeking exempted treatment for any RF emitting devices (be they regulated under Part 18 or Part 15) that are used to power electric vehicles, or any consumer devices within those vehicles. Boeing is aware that the Commission is considering the regulatory requirements for inductive and short range charging devices that would transfer electrical energy through induction or through free space in order to charge the fuel cell batteries of electric cars, or the batteries of consumer devices within those cars. This petition focuses solely on Part 18 ISM devices used in the monitoring and control of transportation vehicles and does not seek to address the more complex issues regarding RF equipment used in an electric vehicle's power system.

As discussed above, numerous vehicle components employ ISM technology for monitoring and control systems. In designing aircraft to incorporate such components, Boeing employs extreme diligence to ensure that any RF emissions that leak from such components are adequately shielded so that they cannot affect critical communication and navigation systems, other RF components, or consumer devices that are permitted within the cabin of the aircraft. Boeing also completes thorough RF emissions testing of the entire aircraft once it is assembled to ensure that RF transmissions produced either within the aircraft or from external sources do not interfere with the safe, effective and reliable operation of aircraft flight systems. Boeing anticipates that manufacturers of other transportation vehicles take similar precautions.

Countless examples exist of ISM technologies that are employed in products and equipment in a manner that do not pose a risk of harmful interference to other spectrum uses. The Commission should therefore apply the same exemption that it employs for digital devices to all ISM equipment employed exclusively on transportation vehicles in order to promote the expanded use of such technologies by manufacturers.

B. The Commission Should Create an Explicit Exemption of its Technical Standards and Equipment Authorization Rules for Maritime Vessels

As the Commission is aware, rapid technological developments are currently taking place with respect to aircraft and automobiles involving the use of wireless systems, digital processing, and sensors in order to enable them to operate in a more safe and efficient manner, with the potential ultimate goal of autonomous operations. Less well known is that these same technological developments are taking place in the maritime sector, where autonomous surface and submersible vessels are already being deployed for various beneficial purposes. These autonomous vessels employ large numbers of wireless systems, digital processors, and ultrasonic sensors in order to navigate, operate safely, and execute their missions.

Given the fact that these vessels are autonomous, their operations pose no risk of harmful RF interference to individuals or other authorized spectrum uses. Nevertheless, the Commission's rules currently do not include an explicit exemption from the technical standards and equipment authorization requirements for the various Part 15 and Part 18 components that they contain. Boeing therefore recommends that the Commission create an explicit exemption in Section 15.103 of its rules for digital devices that are employed within maritime vessels. Consistent with Boeing's comments above, this new exemption should also be applied to Part 18 ISM equipment.

Further, it would be justifiable to apply this new exemption to all forms of maritime vessels, not just those that operate autonomously. The Commission's existing exemptions for aircraft and automobile components have not resulted in appreciable interference to other authorized spectrum uses. There is no reason to believe that an exemption for components employed on maritime vessels would produce a different result. Instead, maritime vessels are usually much larger and spacious than aircraft or automobiles, with much greater segregation between the areas designated for passenger and the vessel's operational systems. Therefore, an exemption for components used in all maritime vessels would be warranted.

If the Commission is hesitant to adopt an exemption for all maritime vessels, Boeing would urge the Commission to adopt expeditiously an exemption solely for autonomous maritime vessels, including both surface and submersible vessels. Such an exemption would provide immediate benefits to equipment manufacturers by permitting them to employ wireless sensors and ultrasonic equipment more expeditiously and in greater quantities on autonomous vessels in order to further enhance their operations and their ability to operate in a safe and efficient manner.

II. CONCLUSION

The U.S. manufacturing and technological sectors are focused on a herculean challenge – the use of RF components, digital processing and sensors to further increase the safety and efficiency of transportation vehicles, with the ultimate goal of autonomous operations. Many of the components that are being employed in this effort pose a negligible risk of causing harmful interference, but are nevertheless subject to divergent regulatory requirements pursuant to different portions of Part 15 and 18 of the Commission’s rules.

The Commission has a statutory mandate to promote the development of new technologies and services. The Commission also is furthering its stated goal of greatly reducing regulatory burdens that impede growth in domestic commerce. Consistent with these goals, the Commission should greatly reduce the regulatory burdens to manufacturers of transportation vehicles and their suppliers by expanding the scope of the exemption that already exist within Section 15.103(a) of the rules, and extending the exemption to Part 18 ISM devices that are employed exclusively in the monitoring and control systems of transportation vehicles, including cars, trucks, airplanes, and maritime vessels.

Respectfully submitted,

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